STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING

RICK SNYDER
GOVERNOR

C. HEIDI GRETHER
DIRECTOR

June 1, 2018

VIA E-MAIL and U.S. MAIL

Mr. Shannon Johnson, PE
Senior Manager, Remediation – Environmental Engineering, Environmental Affairs
Georgia-Pacific LLC
133 Peachtree Street, NE
Atlanta, Georgia 30303

Dear Mr. Johnson:

SUBJECT: Michigan Department of Environmental Quality (MDEQ) Comments for OU5 [Operable Unit 5] Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site, Area 3 Draft Feasibility Study (FS), dated January 19, 2018, Prepared by Amec Foster Wheeler, Environment & Infrastructure, Inc.

Based upon our review of this document and ongoing discussions between the United States Environmental Protection Agency (USEPA), Georgia-Pacific, and the MDEQ, the MDEQ supports the USEPA's disapproval of this document. The MDEQ has provided comments in this letter and supporting enclosure for consideration in the revised report prior to submittal.

Although the draft FS report provides several remedial alternatives, the MDEQ agrees with the USEPA that additional information is required to support and clarify alternatives and address inconsistencies in the document. Detailed comments from the MDEQ regarding the report are provided as an enclosure to this letter and a brief summary of a few key issues identified in the enclosed are summarized below.

- The mapping and data analysis techniques used to determine the remedial footprints (e.g. mean vs. median) need to be refined to better understand risk to receptors and produce accurate excavation volumes and cost estimates for each alternative. The MDEQ believes the large variance in excavation volumes between the mean and median datasets is the result of not having the sample density required to adequately understand the nature and extent of contamination in Area 3 and the collection of additional samples will be necessary to refine remedial footprints and volumes.

- The effectiveness and benefit of the Time Critical Removal Action (TCRA) conducted in Area 3 will only be realized and quantified through the collection of empirical data from a variety of matrices over a prolonged time period following completion of the TCRA and the overall benefit may be greater or lesser than what was expressed in the FS. Modeling in the FS shows significant acceleration toward achieving the fish tissue Remedial Action Objective (RAO), RAO 1, upon completion of the TCRA. This is based, in part, on results from the Bryant Mill Pond (BMP) TCRA. Unlike the Area 3 TCRA, the BMP TCRA was streamlined based on site conditions, that is, it was identified that the contamination existed in a gray clay matrix usually overlying layer of

uncontaminated peat and/or gravel layer, so flexibility was given to operators to excavate shallower or deeper based on visual indicators. As a result, the removal of contaminated sediments (i.e. source material) was significantly more complete at the BMP as compared to the Area 3 TCRA and use of the BMP removal model may be inappropriate for use in predicting fish recovery resulting from the Area 3 TCRA removal efforts.

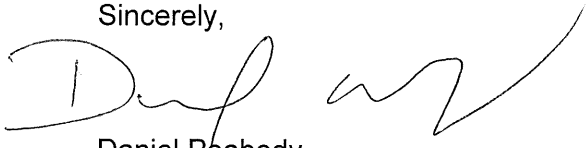
- This document and future FS submittals would benefit from the elimination of language biased toward selection of a particular alternative as well as a wider range of alternatives. The range of alternatives provided in the document are narrow in both cost and scope when eliminating Alternative 1 (No Action) and Alternative 5 (Aggressive Area-wide excavation) and, for the Pine Creek Impoundment, only one remedy (monitored natural recovery) is presented for all Alternatives. Additionally, suggestive language is included in the document indicating preference for selection of a particular Alternative. Examples of modified alternatives are included in the attached detailed comments.

The detailed comments in the associated enclosure cover the key issues identified by the MDEQ review team. Comments from the MDEQ on the Area 3 Applicable or Relevant and Appropriate Requirements presented in the FS are being submitted to the USEPA under a separate cover letter for consideration and incorporation into the next revision. The MDEQ appreciates the opportunity to participated in the many collaborative sessions leading up to the submission of the draft FS, and to have reviewed and commented on this document.

If there are any questions in regard to the MDEQ's comments related to the review of the document, please contact me at 517-284-5072; peabodyd@michigan.gov; or MDEQ, Remediation and Redevelopment Division, P.O. Box 30426, Lansing, MI 48909-7926.

The MDEQ looks forward to continued progress for Area 3.

Sincerely,



Daniel Peabody
Environmental Quality Analyst
Site Assessment and Site Management Unit
Superfund Section
Remediation and Redevelopment Division
517-284-5072

Enclosure
cc/enc: Ms. Cynthia Draper, Amec Foster Wheeler
Dr. Keegan Roberts, CDM Smith
Ms. Rebecca Frey, USEPA
Mr. James Saric, USEPA
Mr. David Kline, MDEQ
Ms. Kristi Zakrzewski, MDEQ
Mr. Joe Walczak, MDEQ
Ms. Beth Place, MDEQ

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General Comment				

1	---	---	---	Discussions regarding the operation of the water control structure (WCS) at the Pine Creek confluence are inconsistent throughout the document. The WCS is operated and maintained per the requirements of the 1977 Flowage Agreement. The Flowage Agreement has three requirements: 1) That as of December 1, of every year, the water level will be lowered 15 inches to force fish into the stream channel and be maintained at such a level until spring breakup occurs; 2) That during the spring flood season (March 15-May 15) a 1 foot water level be maintained over all the mud flats to insure fish the benefit of all spawning areas but not to exceed a maximum level of 684.8, and; 3) once every five years the impoundment shall be drawn down to the lowest possible level, that is the then current water level of the Kalamazoo River at the mouth of Pine Creek for the months of June, July, and August.
				
				The drawdown of Pine Creek is not completed to flush vegetation. The drawdown is completed, as required by the Flowage Agreement, to manage sediment levels in the impoundment. The DNR utilizes the drawdown to encourage growth of vegetation in the impoundment to better manage the fish and wildlife habitat and improve fishing and waterfowl hunting.
				
				The flow of sediments from the Kalamazoo River to Pine Creek is limited due to the presence of the WCS, but operation of the Pine Creek WCS flushes sediments from Pine Creek in to the Kalamazoo River as described on pg. 3-6. However, as was observed during the 100-year flood event in February 2018, the Kalamazoo River can reach a level where water from the river over tops Jefferson Road thereby creating a potential temporary connection for sediments from the Kalamazoo River to flow in to Pine Creek. Additionally, aerial imagery collected during the Time Critical Removal Action (TCRA) in Area 3 show sediments being mobilized from Pine Creek and flowing into the Kalamazoo River during drawdown. Therefore, while the Kalamazoo River does not convey sediments into Pine Creek, unless Jefferson Road is overtopped by flooding, sediments are transferred from Pine Creek in to the Kalamazoo River.
				
				There is very little on the chemical concentration data that exists for Pine Creek as well as the fish populations and current fish consumption advisory status in Pine Creek.
				
				To address the above concerns:
				
				• Please revise sections discussing the operation of the Pine Creek WCS so they are consistent throughout the document.
				• Include additional discussion on the natural and anthropogenic connection between Pine Creek and the Kalamazoo River and how it will impact the proposed remedy for each of those areas utilizing knowledge and lessons learned from the TCRA, recent weather events, and data from previous investigations. This may include but not be limited to:
				  • A review of the historic sediment core data, aerial photographs and bathymetry in the confluence and portions of the channel downstream and a discussion on the potential for contaminated sediments from Pine Creek mobilizing and being deposited within the downstream subarea of Area 3, and
				  • A discussion on how the mobilization of sediments (“clean” or contaminated) impacts the potential for MNR in Pine Creek and/or portions of the downstream subarea where no further action is planned following completion of the TCRA.
				• Please also include discussions on the existing soil, sediment, and fish tissue data for Pine Creek (particularly as they pertain to monitored natural recovery), as well as the status of any fish consumption advisory.

2	---	---	---	The work scope and cost range of Alternatives provided is narrow when removing the “No Action” (Alternative 1) and “Aggressive Excavation” (Alternative 5) and suggestive language and bias toward Alternative 2 was expressed in the document. For future Feasibility Studies, please make a

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				concerted effort to provide a wider range of alternatives, in both scope and cost, and remove suggestive language showing preference towards a Alternative. For example, consider costing and scoping an intermediate RAL of 17ppm or similar or alternative excavation depths.
3				During Remedial Design, it will be important to consider the City of Otsego Master Plan and planned land use changes, particularly in the area immediately downstream of the Otsego City dam on the left descending bank.
4				There are large differences in excavation volumes when using the mean or median contaminant levels to produce remedial footprints. The large difference in volumes suggests that ultimately our understanding of contaminant distribution within the floodplains is limited and will need to be refined through future sampling. Revise the document accordingly to acknowledge this uncertainty, and the need for further delineation of contaminant extent.
5	---	---	---	When discussing percentages of samples above or below remedial action levels, please provide the number of samples used in addition to the percentage.
6	---	---	---	There is little to no discussion on the nature and extent of dioxin and furan contamination in Area 3 and no figures or tables provided summarize the dioxin and furan data collected during the 2011/2012 Supplement Remedial Investigation. Please include discussions (as well as figures and tables) on the nature and extent of dioxin and furan distribution in all media (soils, sediments, tissue) and update all relevant sections of the document with those discussions.
7				In the December 2017 Work Group meeting, there was discussion on the mapping and smoothing process that was utilized to determine the Area 3 remedial footprints and the percent protectiveness for each Remedial Action Level (RAL). The discussion and MDEQ's concern centered around home ranges being run on a smoothed map assumes that all material within a remedial boundary is above the selected RAL, which is not true, and does not properly account for and propagate uncertainty. Upon receipt of the revised Feasibility Study, MDEQ will be evaluating RAL 15ppm, 17ppm and 20ppm and verifying the percent protectiveness of each presented.
8	---	---	---	A review of the historic aerial photos shows a historic raceway existed from upstream of the Otsego City dam to below the City dam and entered the Kalamazoo River near RM 52.5. Significant PCB concentrations are found in floodplain and bank soils near the former raceway (>50ppm from 12-24") as well as edge sediments and bank soils in the depositional area located immediately downstream of the former raceway as is shown on Figure 1-6g. Please update relevant sections to discuss the historic raceway and its potential impact on contaminated sediments and soils in the upstream subarea. The aerials from 1986 and 1999 also also show a narrowing of the channel in the upstream subarea relative to the other historic aerials indicating that the upstream subarea may have been influenced by historic dam operations. Revise discussions regarding long-term channel stability for the upstream subarea accordingly.
9				The document assumes Monitored Natural Recovery (MNR) for Pine Creek. In order to determine the effectiveness of MNR within the Pine Creek impoundment, temporally spaced, empirical evidence of declines in fish tissue COC concentrations, declines in surface sediment COC concentrations, deposition of clean sediments above more contaminated sediments, etc. must be shown, and not just assumed. Revise the text to provide a detailed discussion of the empirical lines of evidence being used to determine the applicability of MNR to the Pine Creek impoundment.
Specific Comments				
10	ES-1	Site History and Setting	Nonpaper sources of PCBs have also been identified throughout the watershed.	If nonpaper sources of PCBs that contribute to the PCB mass within the site have been identified throughout the watershed, identify these sites in the text, or identify the other site documents where these sites are listed. Alternatively, revise the document to discuss the relative magnitude of the other sources, as Case 1:11-cv-00483-RJJ ECF No. 921 filed 03/29/18 has stated: "The Court acknowledges the possibility of some contributions apart from carbonless copy paper (CCP), but the Court concludes as a matter of fact that the vast majority of the PCBs are linked to CCP. Moreover, the Court is satisfied as a matter of fact and law that there is no proper basis for parsing out the PCBs that may be unrelated to the CCP. The costs of addressing the PCBs linked to CCP would not be materially lower even if there were some way to quantify and then divide any non-CCP sources of PCBs"

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11	ES-3	Site History and Setting	The interconnection and potential for PCBs to migrate into Pine Creek is the reason that a portion of the Pine Creek Impoundment is included in this FS	The entirety of the Pine Creek impoundment should be included in the FS, unless it can be scientifically justified that only a portion of the site should be included. Revise the document accordingly.
12	ES-5	Figure ES-3	---	Pine Creek should be added to the "FS Area". Revise accordingly.
13	ES-6	Nature and Extent of Sediment Contamination		For document clarity, revise the text of this section to identify the figures where soil and sediment COC concentrations are presented.
14	ES-6	Nature and Extent of Sediment Contamination	---	It would be beneficial to compare concentrations of sediment samples from the Kalamazoo River and Pine Creek, and SWACs, to the same concentration thresholds (0.33 mg/kg and 1 mg/kg) throughout the section. Currently, comparisons are made to 0.33, 1, 5, or 10 mg/kg, depending upon paragraph.
15	ES-8	Constituents of Concern	The available data indicate that exposure to PCBs will drive risks at the Site, and that management of risks due to PCB exposure will also address risks associated with other constituents (Amec Foster Wheeler 2015b).	Revise the text to note that dioxin/furan contamination has been determined to contribute to risk in Area 4, and that dioxins/furans were identified as a COC and a final remediation goal for residential exposure was included in the Area 2 Record Of Decision. Also revise the statement to note that management of risks due to PCB exposure ***may*** also address risks posed by other constituents. (emphasis added for comment clarity).
16	ES-8	Risk Assessment Summary, 2nd paragraph	However, highly exposed, high-sensitivity vermivorous birds have not been observed at the Site in over 30 years of surveys conducted by the Kalamazoo River Nature Center.	High-sensitivity birds may not be present at the Site due, in part, to high concentrations of contaminants (PCBs, dioxins and furans) in soils, sediments, and biota. Remove this statement or revise the text to indicate that high-sensitivity birds may not be present, in part, due to the presence of contaminants from historic paper mill operations.
17	ES-8	Risk Assessment Summary, 2nd paragraph	However, other lines of evidence indicate no adverse effects on shrew populations.	This is not consistent with the discussion presented in the Area 3 SRI Appendix K, which states that "…the potential for risk to vermivorous mammals is likely, but is limited to a small areal extent." Please revise the statement and provide the "other lines of evidence" used to determine there are no adverse effects on shrew populations or delete the statement.
18	ES-8	Constituents of Concern, 1st paragraph	PCBs are the constituent of concern.	When defining constituents of concern (COC), it is more accurate to state: COCs are PCBs and D/F and DLC measured as TEQ. Revise the document accordingly.
19	ES-9	RAOs and PRGs	RAO 5: Protect people that reside in Area 3 from exposure to PCBs that exceed protective levels. This RAO is intended to protect local residents from exposure to PCB concentrations that may cause a carcinogenic risk greater than 10^{-6} or a HI greater than 1.	In addition to PCBs, dioxins and furans have been identified as a COC in Area 3. Please revise the RAO 5 statement to read: "Protect people that reside in Area 3 from exposure to COCs that exceed protective levels" or please provide a discussion on a residential PRG for dioxins and furans. Additionally, the residential and nonresidential site-specific PCB criteria developed are based on the 1 in 100,000 (10^-5) cancer risk. Please revise.
20	ES-11	Table ES-1; Capping		The table states that capping has "Limited Effectiveness in high flow, erosive conditions." MDEQ notes that subaqueous sediment caps can and are designed to withstand erosive forces (including with habitat considerations) at many sediment Superfund sites.

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21	ES-14	Area 3 Remedial Alternatives, 2nd paragraph	Remedial alternatives were developed by assembling combinations of the remedial technologies screened. Elements common to each alternative, except for the no-action alternative, are listed below.	As stated in the Executive Summary, a limited number of sediment and fish tissue samples exist for Pine Creek Impoundment and significant concentrations of PCBs exist within our ecological exposure zone (0-24"), at locations such as: OSED-08 (5.88ppm at 0-2", 11.7ppm at 2-6" and 12.5ppm from 6-10"); FF-66 (15.7ppm at 6-12"), OSED-02 (6.4ppm at 6-12" and 3.42ppm at 12-16"); OSED-05 (14.8ppm at 12-15"), and; OSED-06 (6.89ppm at 6-11" and 15.3ppm at 11-15"). While monitored natural recovery (MNR) may be included as all or part of the remedy for Pine Creek, additional data collection will be necessary to determine if and to what degree MNR is viable. Additional alternatives for Pine Creek should be considered and presented in the event MNR is determined to not be an effective remedy for this subarea. Subsequent sections of text describing the nature and extent of PCB (COC) contamination in Pine Creek would be enhanced if a more detailed discussion of the analytical data available for Pine Creek were added and the data were compared to relevant decision-based remedial action levels (i.e. 0.33ppm, 1ppm, etc.). Revise accordingly.
20	ES-15	A-2	Caps would be constructed of a permeable geotextile overlain with 1.5 feet of common fill and 6 inches of topsoil, and vegetated.	Revise the text to provide the rationale behind the selected 2 ft floodplain cap thickness, as compared to a lesser or greater cap thickness.
21	ES-15	A-2	Capping can be less destructive and disruptive to habitat, and is less costly to implement than excavation.	Remove the statement that capping is less destructive to habitat than capping, or provide significant evidence to support this statement.
22	ES-16	A-2	LTM for fish, sediment, and surface water and fish advisories would be discontinued once fish tissue goals are met.	The LTM should not be discontinued until multiple, successive rounds (MDEQ recommends three) of fish tissue data indicate that fish tissue COC goals have been met. Revise the document accordingly.
23	ES-21	Table ES-23	Years To Reach PRG for SMB	MDEQ does not support the comparative estimation of timeframes for Alternative 1 (No Action) and Alternative 4 (excavation of over 75,000 cubic yards of material). MDEQ agrees the implementation time and natural resource recovery for Alternative 4 would be longer than Alternative 1 but believes the net benefit of excavation has not adequately been captured since the upper, middle, and lower bounds for Alternative 1 and Alternative 4 shown on Figure 4-1a and 4-2a are almost identical. The step-down in fish tissue concentrations in Figures 4-1a and 4-2a are based, in part, on results from the Bryan Mill Pond (BMP) TCRA. Unlike the Area 3 TCRA, the operators at the BMP TCRA excavated material based on visual indicators, that is, the paper residuals (gray clays) were completely removed and operators were given flexibility to dig shallower or deeper based on the presence of gray clays. The benefit of the Area 3 TCRA will only be fully realized and quantified through the collection of samples from a variety of media over a prolonged period and the benefit (step-down) may be greater or lesser than what is projected in the FS models due to the difference in removal strategies and objectives in the BMP and Area 3 TCRAs. Please review the timeframes provided and revise or provide additional discussion to support why a No Action remedy has the same effectiveness and within the same general timeframe as an aggressive excavation remedy such as Alternative 4.
24	1-12	Section 1.3.3.1, 1st paragraph	Over 600 sediment samples were collected throughout Area 3, as listed in Table 1-2. In the upstream subarea, most sediment sample results (approximately 85%) were less than 1 mg/kg	See comment regarding percentages. This statement is misleading. While a significant number of sediment samples have been collected in Area 3, a limited number of those samples have been collected upstream of M89. Please include sample numbers (N) when providing percentages for specific subareas (e.g., upstream subarea) and consistently compare sediment sample results to decision-based remedial goals.

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			PCB. Maximum PCB concentrations for intervals 1 through 6 are shown on Figures 1-6a through 1-6f, respectively.	
25	1-12	Section 1.3.3.1, 2nd paragraph	Pine Creek sediment results are shown on Figure 1-7 and are based on seven cores. PCB concentrations within the Pine Creek Impoundment sediments were generally higher at depths ranging from 6 to 24 inches. Approximately 66% of the samples had PCB concentrations less than 0.33 mg/kg, and approximately 87% were less than 10 mg/kg	That statement is not consistent with ES pg. ES-6 which describes 8 cores. Please revise so that the correct number of sediments cores available is summarized in all relevant sections of the document. Please include sample numbers (N) when providing percentages and consistently compare soil and sediment sample results to applicable decision-based remedial goals and objectives (0.33 mg/kg, 1 mg/kg, etc.).
26	1-12	Section 1.3.3.1, 2nd paragraph	Sediment SWACs were calculated for the upstream subarea and downstream subarea (in relation to the M-89 Bridge) of Area 3 for six sediment depth intervals of 0 to 6 inches, 6 to 12 inches, 12 to 24 inches, 24 to 36, 36 to 48, and greater than 48 inches. Insufficient sample locations were available for the 36- to 48-inch interval and greater than 48-inch interval upstream of the M-89 Bridge.	It is unclear if SWACs calculations for the downstream subarea included Pine Creek. Please revise to include Pine Creek or provide a statement indicating SWACs for Pine Creek were not calculated.
27	1-13	Section 1.3.3.3, 1st paragraph	During the 2013 sampling event, the incremental sampling method (ISM) was used to investigate residential backyards as shown on Figure 1-9.	Properties zoned as residential within the Area 3 study boundary are not shown on this figure. Please revise Figure 1-9 to show all privately-owned properties that could be residential in the future as well as properties currently zoned as residential.
28	1-14	Section 1.3.3.4, 1st paragraph	Thirty soil and sediment samples were analyzed for inorganic metals, volatile organic compounds, semivolatile organic compounds, pesticides, and dioxins and furans.	It is unclear if the number of sediment and soil samples being referenced are all from Area 3 or if they were collected in other Areas of Operable Unit 5. Please revise the document or provide additional information on the dioxin and furan sediment investigation. This statement would better inform the reader if the amount samples specific to Area 3 were included, the number of samples was further broken down by each subarea (upstream and downstream), and a more specific sample location (bank soils, floodplain soils, edge sediments, main channel sediments) was provided. Of the 17 non-PCB soil samples collected in Area 3 only 2 are in the upstream subarea (upstream of M89). Only 8 non-PCB sediment samples were collected and analyzed for dioxins and furans across Areas 1,2 and 3 and summarized in the non-PCB investigation so the nature and extent of dioxins and furans in sediments and soils within Area 3 is not well understood.
29	1-16	Section 1.3.5, 2nd paragraph	Soils and sediments upstream of the M-89 Bridge containing PCBs are unevenly distributed in Area 3 at varying depths.	This statement seems to indicate that the transport and deposition of PCB contaminated sediments resulted in periodic “pulses” of contamination to the floodplains and river channel in the upstream subarea and directly contradicts the statement made on page 1-13: “The factor with the most influence over the distribution of PCBs in floodplain soils was the former Otsego Dam Impoundment. Historic higher water elevations and occasional flood events dispersed PCB-containing sediments over the (now exposed) wide floodplains that flank the river in the downstream subarea. The entrenched and incised upstream subarea was not significantly affected by the former Otsego Dam Impoundment in terms of flood events and higher water elevations.”

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				Revise accordingly or please clarify.
30	1-17	Section 1.3.5, 5th paragraph	A general CSM cross-sectional diagram was prepared to summarize the uneven distribution of PCBs in soils and sediments, and to highlight major fate and transport processes. The general CSM diagram for Area 3 is shown on Figure 1-11.	It was previously stated that PCBs in the upstream subarea are unevenly distributed at varying depths; however, Figure 1-11 shows that bank soils and sediments were addressed during the TCRA. This figure also shows the historic pool elevation that would not have been different than the normal river stage for the upstream subarea so the transport of contaminated sediments into the floodplain is not adequately described. If the distribution of PCBs that occurs below M89 is uneven like the upstream subarea then no revision is required. If the model shown on Figure 1-11 is unique to the upstream subarea, please remove references to the bank soils and sediments being addressed during the TCRA as well as the former high pool elevation. If Figure 1-11 is applicable to only the downstream subarea, please revise the text accordingly.
31	2-2	Section 2.2, 4th paragraph	MDCH issued a fish advisory for parts of the Kalamazoo River extending from Morrow Lake Dam to Lake Michigan (MDCH 2010). The advisory, from Morrow Lake Dam to the Allegan Dam and on Portage Creek downstream of Monarch Mill Pond, recommends that the general population not consume carp, catfish, suckers, SMB, and largemouth bass on the Kalamazoo River. Between Allegan Dam and Lake Michigan, the advisory recommends that the public not consume carp, catfish, or northern pike. Healthy adult males are advised to eat no more than one meal per week of all other species. For women of childbearing age and children under 15 years of age, no consumption of any species is recommended for fish caught above Allegan Dam (including Area 3). The fish consumption advisory issued by MDCH is only a recommendation, is not legally binding, and has limited effectiveness in protecting human health.	Please review the new MDCH Fish Advisory language and the 2018 Eat Safe Fish Guide and ensure the language in the document is consistent with the advisory signage posted in Area 3 in this section and all other relevant sections of the document. In general, the current advisory is no consumption for all species from Morrow Dam to Lake Allegan for all ages, a limited consumption advisory for certain species downstream of Lake Allegan and Pine Creek for people of certain ages and health status. Please also include a discussion on the Fish Consumption Advisory in Pine Creek shown below. **Pine Creek & Impoundment** (upstream of Jefferson Road Dam) Type of Fish / Chemicals of Concern / Size of Fish (length in inches) / MI Servings per Month* Bluegill / PCBs / Any / 4[2x] Carp / PCBs / Any / 1[2x] Largemouth Bass / Mercury / Under 17" / 2 Largemouth Bass / Mercury / Over 17" / 1 Smallmouth Bass / Mercury / Under 17" / 2 Smallmouth Bass / Mercury / Over 17" / 1 Sunfish / PCBs / Any / 4[2x]
32	2-2	Section 2.1, 7th paragraph	RAO 5: Protect people that reside in Area 3 from exposure to PCBs that exceed protective levels. This RAO is intended to protect local residents from exposure to PCB concentrations that may cause a carcinogenic risk greater than 10-6 or a HI greater than 1.	The site specific residential criteria for PCBs is based on the 1 in 100,000 (10^-5) cancer risk. Revise accordingly.
33	2-5	Section 2.3, 12th paragraph	Michigan's soil and sediment cleanup criteria for PCBs were reviewed, but were	The site specific 2.5 mg/kg criterion for residential direct contact with soil was more protective than the State of Michigan's generic residential soil direct contact criteria (SDCC) of 4,000 parts per billion (ppb), or 4 mg/kg, from the time it was developed until the present. Michigan has developed

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			not considered ARARs for soil direct contact. Michigan Admin Code R. 299.49, footnote [T], which references soil direct contact criteria for PCBs, identifies PCB cleanup standards to be used if TSCA standards are not applicable. Federal regulations at 40 CFR Part 761 were identified as relevant and appropriate requirements for OU-5. In this case, there are site-specific criteria developed for PCBs for soil direct contact for Area 3 pursuant to Part 761. Therefore, Michigan's Part 201 criteria for PCBs for soil direct contact will not be considered ARARs.	updated criteria under Part 201, which have been submitted to the State's Office of Regulatory Reinvention and were released for public review in August 2017. The new criteria include a generic residential SDCC value for total PCBs of 1,900 ppb, or 1.9 mg/kg, which is more stringent than the FRG of 2.5 mg/kg for residential floodplain soils used in the Record Of Decision for Area 1 and Area 2. The updated criteria use the same oral toxicity factors (reference dose and cancer slope factor) as the 2003 CDM HHRA to evaluate risk, but also take into account the risks posed by developmental toxicants such as PCBs, and assumed a child receptor in the residential setting. Because of these changes, the more-stringent 1.9 mg/kg value is part of the comprehensive rules package that is in the promulgation process, and the State of Michigan will be identifying this lower standard as an Applicable or Relevant and Appropriate Requirement (ARAR) for this and future proposed remedies for the Kalamazoo River. Part 201 criteria were not previously considered as an ARAR for Area 3 soil direct contact for PCBs expressly because Michigan's PCB criteria were not more stringent than the site-specific criteria for PCBs, but this will not be the case going forward. For Area 3, the State of Michigan recommends modifying the FRG for Floodplain Soils in residential areas to 1.9 mg/kg.
34	3-2	Section 3.1.1.2, 1st paragraph	Waterway use restrictions, such as limitations on anchoring or access to prevent damage to bank treatments, may also be implemented.	How would these Institutional Controls (IC) be enforced? For instance, would signage be placed to inform recreators where they can and cannot anchor, access the banks, etc.? Who would be responsible to monitor the effectiveness of the ICs and was this captured in the Post Removal Site Control Plan for the TCRA? Please elaborate further on this IC if it is intended to be utilized as part of the remedy.
35	3-6	Section 3.2, 4th paragraph	MNR is proposed for Pine Creek sediment based on fish tissue concentrations and risk calculations completed for fish ingestion in the Pine Creek Impoundment. Risk associated with fish ingestion from this area is within an acceptable range for central tendency and high-end sports anglers, and is slightly above the acceptable range for subsistence anglers.	Additional data and associated discussion of temporal trends in empirical evidence are required before MNR can be considered for the Pine Creek impoundment. Until MNR for Pine Creek can be substantiated, MDEQ believes an additional remedy or alternative for Pine Creek should be outlined in the FS. The operation of the Pine Creek WCS and its impact on the transport and deposition of clean, upstream sediments in Pine Creek and the burial of contaminated sediments in the investigation area will also need to be considered in this FS evaluation and ultimately evaluated during RD sampling.
36	3-7	Section 3.1.1.2, 3rd paragraph	A second floodplain interpolation was performed for the mean and median which included 13 additional TSCA verification samples (Figures C-12.1a to C-12.7b). This second interpolation was performed to assess the difference in the interpolated areas at or above 50 mg/kg for costing material handling under TSCA. This second interpolation was not used to estimate the outer boundary of the remedial footprint, although there is less than a 1% difference in surface area above	It is unclear what is meant by "..where historic data with concentrations above 50 mg/kg could not be verified." The presence of soils or sediments above 50ppm was "verified" during historic sampling based on analytical results from a certified laboratory, which is why the location is of interest and was revisited. No individual sample "verifies" the results of another; rather, samples should be used collectively to inform the reader on the nature and extent of contamination in a particular area or feature. The large range of TSCA material volumes using the "verification" (i.e. step-out) sample approach highlights MDEQ's assertion that using the "verification" sample strategy when dealing with extreme values will serve to dilute the dataset and shrink remedial footprints. The sample plan currently used to "verify" concentrations greater than 50 parts per million (ppm) does not consider the likelihood of encountering soils or sediments at or above those extreme values (e.g. >50ppm) which is a fatal flaw. A write-up summarizing the issues with step-out sampling near extreme values is included as Attachment 1.

Document:	Draft Feasibility Study Area 3 OU-5 Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site (January 19, 2018)			
Comment Author:	Michigan Department of Environmental Quality (June 1, 2018)			
Comment #	Page	Section and paragraph	If applicable, specific quotation from text	Comment
			the floodplain PRG of 11 mg/kg between the two interpolations. The volume of potential TSCA material ranges from 450 CY (using the median interpolations with verification samples) to 3030 CY (using the mean without the verification samples). The lower range of 450 CY plus a contingency of 25% was selected based on experience in implementing the TCRA where historic data with concentrations above 50 mg/kg could not be verified.	
37	3-9	Section 3.2.4	The resulting minimum home range protectiveness at the ecological PRG of 11 mg/kg for RALs 25, 20, and 15 run on the mean pixelated (non-smoothed) composite interpolation were 94.9, 98.4, and 100%, respectively (Table D-3).	Revise the text to include the uncertainty associated with the interpolated minimum home range protectiveness.
38	3-10	Section 3.2.5	---	Additional parcels zoned as residential exist within the study boundary upstream and downstream of M89 in Area 3 and are not discussed in this section. In addition to what is shown on Figure 3-14, please add properties currently zoned as residential and the parcel boundaries. For parcels where ISM sampling was or will be completed using the standard 0-6" and 6-12" intervals, please provide a summary of the sediment transport model discussing the likelihood and amount of sediment potentially being deposited on these properties during flood events and how that information will or will not be used to inform ISM sampling. Revise accordingly.
39	4-2	Section 4.2	ALTERNATIVE 2 (A-2) – CAPPING OF FLOODPLAIN SOIL TO RAL 20 OUTSIDE OF TCRA AREAS, TARGETED TSCA MEDIA EXCAVATION, UPSTREAM BANK SOIL/SEDIMENT EDGE EXCAVATION WITH BANK PROTECTION AND RESTORATION (ECs), PINE CREEK MNR, ICs FOR PRIVATE RECREATIONAL PARCEL, AND LTM	Tables for Alternative 2 show 0 CY of TSCA material from floodplain. Revise accordingly.
40	4-12	Table 4-2 to Table 4-5	Soil To TSCA Landfill	The volume of soils calculated to be sent to a TSCA landfill for Alternative 5 is up to 50x higher than the estimate from other Alternatives and there is significant variability of TSCA volumes for Alternatives 2,3 and 4. Please explain why the volume of TSCA material is much higher in Alternative 5 compared to Alternatives 2,3 and 4, as well as the variability of TSCA soil volumes in Alternatives 2,3 and 4.

Appendix A

Step-out Sampling

Appendix A.

Biasing Effect of Step-out Sampling

A-5.2.2 What About "Step-Out" Samples?

The use of "*step-out"* sampling is an increasingly common practice for site investigations. Focused investigation in the vicinity of existing sample locations adds samples surrounding areas where elevated contaminant concentrations have been found in previous rounds of sampling. These step-out samples represent a common source of bias in SWAC estimates based on weighted averages, such as those based on IDW or Thiessen polygon interpolation or other weighting schemes. The following example illustrates that incorporation of step-out samples may cause unintended biases in SWAC estimates, and that such biases are not corrected by spatially weighted averaging.

A random sample of size 9 was selected from a lognormal distribution and assigned to the nodes of a systematic grid. The true probability density of the underlying lognormal distribution is plotted in Figure A-1 and the true mean (4.5) is shown as well as the largest value drawn in the sample (11.5). The sample locations are posted in the Figure A-2 (panel A), showing that the largest sample value is located within the center of the grid. Four additional step-out locations were identified 2.5 meters from the largest value in each of the cardinal directions and new samples were drawn at random. The resulting sample values and modified Thiessen polygons are shown in Figure A-2 (panel B). It is commonly argued that the SWAC would be estimated based on sample weights defined by these new Thiessen polygons, including the step-out samples which have served to "refine" understanding of the size of hotspots. It is often ignored that the original sample provides an unbiased estimate of SWAC, regardless of the findings of the step-out samples.

Table A-1 provides the example data and comparison of estimates obtained with and without step-out samples with the true mean of the underlying distribution. The simulated data are lognormal with mean 1.0 and standard deviation 1.0 and have true population mean given $e^{\left(\mu+\frac{\sigma^2}{2}\right)} = 4.5$. Table A-1 shows that the weights for estimating the mean without step-out samples are all 1/9 = 0.11 for the systematic data and 0.0 for the step-outs. Sample weights are proportional to the polygon area for the Thiessen polygon approach. When step-outs are included, the weight for the sample surrounded by step-outs is greatly reduced from (0.11) to (0.023), nearly a full order of magnitude reduction in the influence of the sample value on the estimated mean. The Thiessen weighted and unweighted estimates were 3.6 and 4.57 respectively resulting in a 20% low bias in the weighted estimate in contrast to a 2% relative error in the un-weighted estimate.

This analysis is just one example from synthetic data, so one might question if this result is expected or if this is an unusual combination of samples and data configuration. This result is driven largely by the fact that the resulting weighting factor for targeted values is made small by surrounding the location with step-outs, and also the fact that the resulting step-out samples themselves are less than the original sample. Did this happen by chance alone or is this to be expected in practice?

First, the Thiessen polygon size can be made arbitrarily small simply by selecting step-out locations arbitrarily close to the target location. In fact, the weight for this example is much higher than would be achieved in most real-world situations, because the area of most sites is nearly infinite when compared with a small polygon of 20 square feet or so. For example, at a 50 acre site with 100 sample locations, 2.5m step-outs would result in a sample weight on the order of 1 in 10,000 as compared with equally weighted samples of 1 in 100. Insertion of step-out samples provides a means to effectively censure individual sample locations from the estimate of SWAC.

One might conjecture that the additional step-out samples themselves could mitigate the problem by assigning additional spatial weighting to the target area. Unfortunately, this is not the case because while additional samples from the area do indeed increase the weight assigned to the area, the subsequent samples nearly always mask information about the tail of the concentration distribution from the SWAC estimation formulas. Consider in this case that the maximum value in the original sample was 11.5, which is the 90th percentile of the underlying lognormal distribution. This means that the step-out samples have an inordinate likelihood (90 percent individually) and 66 percent jointly of being smaller than the original sample. So in effect, the hoped for mitigation actually causes a multiplying of the effect, resulting in further biasing of the estimated SWAC. In effect, the use of step-out samples in the vicinity of extreme samples has the effect of creating a trimmed estimate of the mean. In this case, trimming was at the 90th percentile resulting in understatement of risks thought to be proportional to surface average contaminant concentrations.

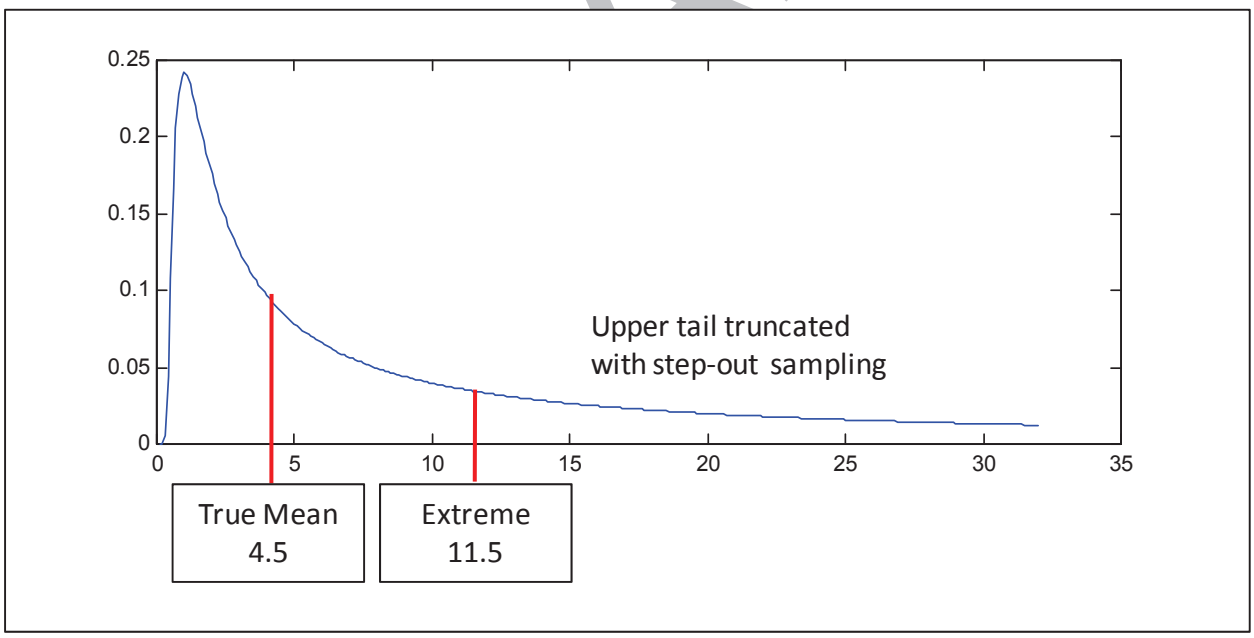

Figure A-1: Lognormal Distribution from which Random Samples Were Drawn for Example Step-Out Calculations. The True Mean of the Distribution is 4.5 and the Largest Sample Value was 11.5 which is the 92nd Percentile of this Lognormal Distribution.

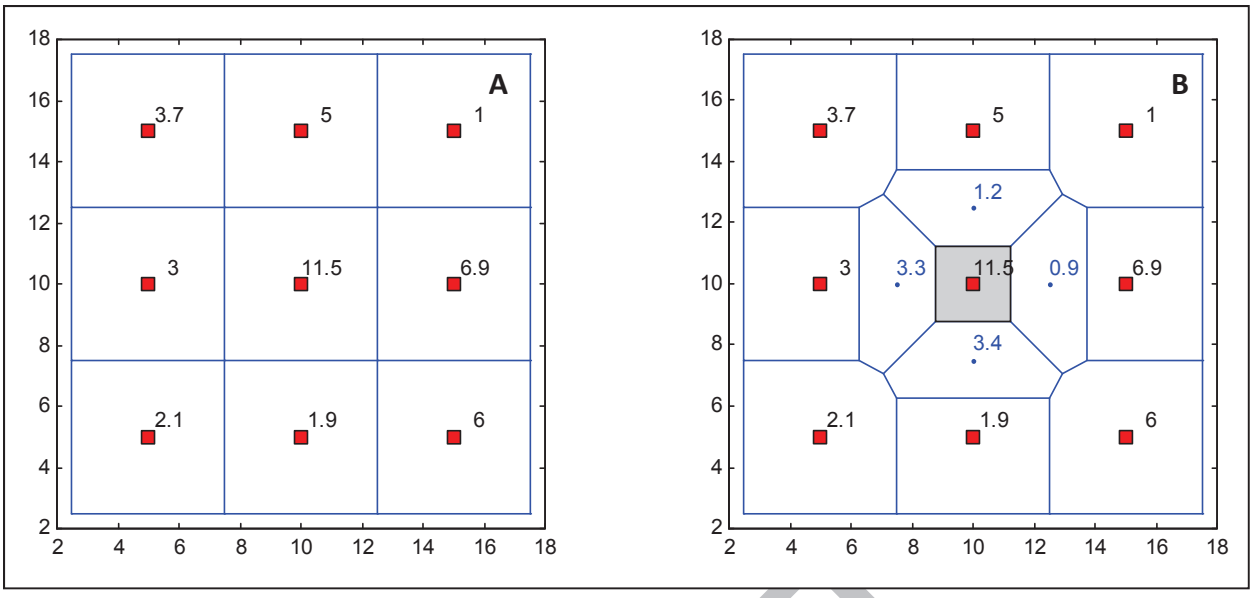

Figure A-2: Systematic Sample of Size 9 from a Theoretical Lognormal Distribution and Thiessen Polygons Overlaid (Panel A) and the Same Sample Data with Four Step-Out Samples and Associated Thiessen Polygons (Panel B).

TableA-1: Hypothetical Example Illustrating the Effect of Step-Out Sampling on SWAC Estimates when Sampling from a Lognormal Distribution

				Weighted Samples	
Sample Type	**Value**	**Systematic Weight**	**Sample Weight**	**Systematic**	**Systematic Plus Stepout**
Systematic	2.1	0.11	0.10890	0.23	0.23
Systematic	3	0.11	0.08340	0.33	0.25
Systematic	3.7	0.11	0.10890	0.41	0.40
Systematic	1.9	0.11	0.08335	0.21	0.16
Focus of Stepouts	**11.5**	**0.11**	**0.02790**	**1.28**	**0.32**
Systematic	5	0.11	0.08320	0.56	0.42
Systematic	6	0.11	0.10890	0.67	0.65
Systematic	6.9	0.11	0.08335	0.77	0.58
Systematic	1	0.11	0.10890	0.11	0.11
Step-out	3.3	0	0.05080	0	0.17
Step-out	3.4	0	0.05080	0	0.17
Step-out	0.9	0	0.05080	0	0.05
Step-out	1.2	0	0.05080	0	0.06
Estimated SWAC				**4.57**	**3.56**

Notes:

1) The true mean for this lognormal distribution is 4.48 so the relative error in this instance is 100% x(4.48-3.56)/4.48 =21%

2) The relative error in SWAC based on the original systematic design is 2%.

So, what about step-out samples? While it is recognized that step-out samples serve several useful purposes, their inclusion in SWAC estimation should be considered carefully, when sampling weights are to be tied directly to individual samples. Ideally managers should require DQOs for SWAC estimation for both RI and risk assessment steps, which provide a sound basis for unbiased estimation of SWAC, avoiding the use of step-out samples. During the RI phase, stratification can be used to obtain "smart" or multipurpose biased data as described above. Estimation based on stratification may be a more appropriate technique when step-out samples are to be included in analyses. For example, if the central group of Thiessen polygons had been identified as an independent stratum prior to collection of the systematic samples, then any number of step-outs could be deployed within this stratum and each sample would be equally weighted with weights given by the sum of Thiessen polygon areas divided by total area, divided by the number of samples in the stratum.

Because this area was identified after the data were collected, any post stratification of the data is biased, but potentially not as biased as direct application of the Thiessen polygon weights. For example, if the central group of five samples were identified post-hoc as an independent stratum, then equal sampling weights would be given to the five samples, equal to the total area of the five Thiessen polygons divided by the total exposure area ((5.78/25=0.2311). This results in post-hoc sampling weights

of (0.231/5=0.0462) for each of the five samples, which is still biased low, but not as greatly as the 0.027 for the focus “hot spot” polygon that was found with Thiessen polygon weighting.

Purging the bias from a biased sampling design is difficult at best and leads to ad-hoc approaches without a sound statistical basis. Recall, there are no statistical methods that are guaranteed to provide unbiased estimates from biased data. Because of this seeming internal inconsistency between objectives geared toward unbiased estimation of SWAC and investigation of particulars of apparently hot locations, it may be necessary to identify samples that achieve only one or a subset of data objectives. For example, inclusion of step-out samples in SWAC calculations can be unnecessary, and may be counterproductive. In general, the objectives of SWAC estimation differ from site characterization and contaminant delineation, so the RPM should consider maintaining separation of data sets intended for these competing objectives.